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ABSTRACT

In this study, the social structure and output of scholars at the University of Illinois are examined in terms of the task characteristics of their academic areas. On the basis of an earlier multidimensional analysis, academic task areas were clustered according to their: (1) concern with objectivity and physical objects; (2) concern with application; and (3) concern with life systems. Depending on the characteristics of their area, scholars differed in (1) the degree to which they were socially connected to others; (2) their commitment to teaching, research, and service; (3) the number of journal articles, monographs, and technical reports they published; and (4) the number of dissertations they sponsored. Moreover, it is shown that the relationship between social connectedness and scholarly productivity depends upon the task area. These findings are discussed in terms of their implications for research on tasks and on universities and for the evaluation of faculty members. (Author/HS)

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RELATIONSHIPS BETWEEN THE CHARACTERISTICS OF ACADEMIC TASKS AND THE STRUCTURE AND OUTPUT OF UNIVERSITY DEPARTMENTS

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Abstract

The social structure and output of scholars at the University of Illinois are examined in terms of the task characteristics of their academic areas. On the basis of an earlier multidimensional analysis (Biglan, 1971) academic task areas were clustered according to their: (1) concern with objectivity and physical objects (hard vs. soft); (2) concern with application (pure vs. applied); and (3) concern with life systems (life system vs. non-life system). Depending on the characteristics of their area, scholars differed in (1) the degree to which they were socially connected to others, (2) their commitment to teaching, research, and service, (3) the number of journal articles, monographs, and technical reports they published, and (4) the number of dissertations which they sponsored. Moreover, it was shown that the relationship between social connectedness and scholarly productivity depended on the task area. These findings are discussed in terms of their implications for research on tasks and on universities and for the evaluation of faculty members.

RELATIONSHIPS BETWEEN THE CHARACTERISTICS OF ACADEMIC TASKS AND THE STRUCTURE AND OUTPUT OF UNIVERSITY DEPARTMENTS[1]

Anthony Biglan

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This paper examines the way in which the task characteristics of academic areas are related to the structure and output of university departments. Relationships between intellective task characteristics and structure and output variables have seldom been examined in organization settings. This appears to be a serious shortcoming in our understanding of organizations when we consider the existing evidence for the effects of the task on structure and output.

Within recent years, the task has emerged as one of the most important determinants of social structure and output. Woodward (1965) showed that the number of supervisory levels and their spans of control were related to the type of manufacturing technology in a sample of English industrial organizations. The relationship between task type and structure has also been demonstrated in small groups (Morris, 1966; Walker and Guest, 1951). Hackman (1966) found that the characteristics of group output depend on whether the task primarily involves discussion, problem-solving, or production. The task also appears to mediate relationships between structure and output. Woodward (1965) showed that in her sample of industrial organizations the type of management structure which was associated with financial success depended on the type of manufacturing technology.

This evidence suggests that intellective task characteristics may be related to organization structure and output. Organizations whose tasks are primarily intellective include universities, research and development firms, consulting firms, and numerous governmental agencies. These organizations are generally made up of highly skilled professionals. Perhaps because of their level of skill and professionalism, concepts such as socialization, norms, and roles have been emphasized in studies of these organizations. In contrast, the present study examines structure and output of one such organization, a university, in terms of the characteristics of its tasks. An analysis of the task characteristics of academic areas was presented in an earlier paper (Biglan, 1971) and is employed in the present study.

Department Structure and Output

Social connectedness among faculty members. Unlike departments in most formal organizations, university departments do not have clear lines of authority in which some members must answer to others. Oncken (1971) showed that the typical university department has a distribution of control which is egalitarian. In the absence of a clear, formal structure, informal relations among colleagues--their social connections--may be crucial to the department's functioning efficiently. Informal social connections also appear important for research activities, at least in the sciences. Hagstrom (1962) found teamwork to be characteristic of physical science research.

Menzel (1962) showed that researchers in the physical sciences obtain

a large amount of the technical information that they use in their work through personal contacts with other researchers. This is true despite the fact that much of the information is available in the literature. Pelz and Andrews (1966) studied the social connectedness of research scientists in the physical and biological sciences. They found that the scientists who are rated as most productive have frequent contacts with colleagues in diverse but related fields.

Despite the apparent importance of social connectedness among scholars, its extent in different academic areas has not been investigated. The present study examines whether social connectedness varies with the characteristics of academic tasks. Of particular interest is the question of whether high social connectedness is characteristic of areas other than physical sciences. A second and equally significant question is whether social connectedness is positively associated with scholarly productivity in areas besides the hard sciences. Despite the evidence just cited for such a positive relationship in hard science areas, the relationship between social connectedness and scholarly productivity has not been investigated in other areas.

Three aspects of scholars' social connectedness are examined in the present study. First, an individual may be connected to others in the sense that he likes working with them. A second kind of connection is the extent to which others influence him. Finally, an individual is connected to others to the extent that he actually collaborates with them. Since teaching and research activities may engender different degrees of social connectedness, the three aspects of connectedness are

examined separately for the two activities.

Commitment to teaching, research, administration, and service. Considerable controversy has raged in academia in recent years regarding the relative emphasis which should be placed on teaching and research. However, little consideration appears to have been given to the possibility that the norms for and significance of emphasis on teaching and research depend on the academic area. Moreover, little attention has been given to the emphasis which scholars place on their administrative and service activities. Commitment to these activities may differ depending on the area.

Available evidence suggests that the extent and nature of the commitment of scholars to teaching depends on their area. Gamson (1966) interviewed faculty members in a small, newly established college concerning their goals. She characterized social scientists' goals as normative; they emphasized the promotion of close, egalitarian relationships with students. Natural science goals were characterized as utilitarian; only cognitive effects of teaching were emphasized; commitment to students was not emphasized. In a similar study, Vreeland and Bidwell (1966) concluded that scholars in social sciences emphasize moral as well as technical training while those in the physical sciences emphasize only the latter. Scholars in humanities departments were more varied in goal orientation. Music, philosophy, and German scholars emphasized only technical training, while those in classics and fine arts also stressed moral training.

Although these studies are informative, they leave a number of

questions unanswered. First, is the apparently greater emphasis on teaching in some areas compensated for by a deemphasis of research? Second, do scholars in different areas also differ in their emphasis on administration and service activities? Third, it is important to find out whether these differences in scholars' goals are associated with differences in the amount of time which they actually devote to these activities. Each of these questions is examined in the present study. Two aspects of the commitment of scholars in different areas to teaching, research, administration,and service are examined: (1) liking for the activity and (2) amount of time actually spent on the activity.

Scholarly output. Existing evidence shows rather conclusively that scholars' work cannot be adequately evaluated in terms of a single measure. Smith and Fiedler (1971) reviewed empirical research on the measurement of scholarly output. They concluded that, at best, there is only moderate convergence among measures. This was true even for the relationship between quantity and quality of publications. Thus, a variety of output measures were considered in this study.

In the case of research, quantity of monographs, journal articles, and technical reports are included as well as a measure of journal article quality which is based on the rated quality of the journal in which it is published. The effectiveness of graduate training at the doctoral level is indexed by ratings of the quality of the first jobs which graduate students obtain upon completing their degree and the number of doctoral dissertations sponsored. Unfortunately, no index of undergraduate teaching effectiveness was available.

Despite research on relationships among scholarly output measures (c.f.,Cole & Cole, 1967), the question of whether these measures differ systematically with academic area appears not to have been examined. The answer to this question has important implications for the way we shall evaluate faculty members. If, for example, faculty members produce different numbers of monographs depending on their area, then we may want to weight monographs differently when evaluating scholars in different areas.

Method

Data on department structure and output were collected at the Urbana campus of the University of Illinois in the spring of 1968. The university is a large state-supported institution with an extensive commitment to research and graduate education. The Urbana campus is the main campus of the university. It has approximately 22,000 undergraduates, 10,000 graduate students and 3,000 full-time faculty. Most academic disciplines are represented there; there are over 100 distinct curricula.

In the early stages of research, data were collected on the organization of 47 departments. Since one purpose of our research was the study of the characteristics of successful graduate programs, only departments granting Ph.D.'s were included in the sample.

Sources of Data

The chief sources of structure and output data were questionnaires, archival records, and faculty members' judgments of certain outputs.

The questionnaire asked scholars about the structure of their social relations and their commitment to teaching, research, adminstration, and service. Department heads in 47 departments were contacted through the Dean of the Graduate College. They were asked to fill out the questionnaire and to ask the members of their department to do the same. The remaining members of the faculty received their questionnaires by mail. Response rates within the departments ranged from 19 percent to 100 percent and the overall rate was 55 percent. Because of their low response rate some departments were deleted from the present study. The average response rate of departments retained in this study was 65 percent.

Archival records provided data about publication quantity and the first jobs which finishing graduate students obtained. An official university pamphlet entitled Publications of the Faculty is published annually. It lists all monographs, journal articles, technical reports, and dissertations sponosred by faculty members during the preceding year. Departmental records provided information on the specific jobs obtained by all graduate students who had completed their Ph.D.'s in the years 1964-1968.

It was important to obtain measures of the quality of jobs and publications as well as their quantity. Our approach to this problem was to ask faculty members to rate the quality of graduate students' first jobs and the journals in which the scholars in our sample had published.

Operational Measurement of Variables

Table 1 lists social connectedness and commitment variables and

describes the specific operations involved in deriving each. All but one of those variables was derived from the questionnaire.

Insert Table 1 about here

Measures of publication quantity were tabulated for each faculty member who received a questionnaire. The quantity of four kinds of publications was tabulated: monographs, journal articles, dissertations sponsored by the scholar, and technical reports.

A measure of journal article quality was derived for each questionnaire respondent who had published at least one article in the period 1964-1967. The measure was based on the ratings of journal quality which were described above. Indexing the quality of individual scholars' articles in terms of the quality of the journals in which they published was based on two assumptions. First, it was assumed that each journal has a minimum standard of excellence for the articles it accepts. Second, it was assumed that this minimum standard varies from journal to journal. If these assumptions are correct, then articles in journals of different quality should themselves differ in quality. The actual quality score for each scholar was obtained as follows. Each of the journals in which the scholar had published during the four-year period of interest was noted and the quality score for that journal was recorded. Then the quality scores were summed and divided by the number of journal articles the scholar had published.

In a similar manner an index of the quality of the first jobs of each

Table 1

Operational Measurement of Social

Connectedness and Commitment Variables

VARIABLE	DESCRIPTION
Social Connectedness:	
Number of Others--like to work with	Respondents to the questionnaire listed people they said they liked to work with on teaching, research, and administration. The number of people named for each of these tasks was the measure.
Number of Sources of Influence	Respondents were asked to indicate the individuals and groups who influenced their research goals and teaching procedures. The number of sources indicated was the measure.
Collaboration	Respondents to the questionnaires indicated the number of fellow faculty members with whom they worked directly on research and teaching. A second measure of research collaboration was obtained by tabulating the number of co-authorships each faculty member had on his journal articles.
Commitment:	
Preferences	Questionnaire respondents were asked to distribute 100 points among the following tasks in accordance with their preferences for each task: teaching, research, department administration, university administration, and service.
Time allocation	In a similar manner, respondents distributred 100 points among these tasks to indicate the proportion of time they spent on each. Since respondents also indicated the number of hours they spent on all university work, it was possible to devise measures of time spent on each activity.

scholar's graduate students was developed. In obtaining ratings of job quality, five or six faculty members in each department were asked to rate the desirability of each job on an eight-point scale, ranging from "very undesirable" to "very desirable." The average interrater reliability of these ratings was .58. As a second measure of the reliability of these ratings, the even-numbered jobs on each department's list were averaged and correlated with the average for ratings of odd-numbered jobs. This correlation, when corrected for length of the list, was .56 for all departments and .72 for departments with lists of at least 14 jobs. Once the average job quality rating was available for each job, the measure of the quality of the jobs of each scholar's graduate students was derived by averaging the job quality scores of all of the scholar's graduate students.

Analysis of Data

In an earlier paper (Biglan, 1971) a multidimensional analysis of 36 academic task areas was presented. Briefly, three dimensions were derived from the judgments of scholars at the University of Illinois. The dimensions involved: (1) concern with objectivity and physical objects (hard-soft), (2) concern with practical application (pure-applied), and (3) concern with life systems. It is possible to cluster the task areas on the basis of their position on each of these three dimensions. Table 2 presents an organization of areas in eight clusters. The table lists the areas included in each cluster. Each cluster centroid is located in a different octant of the three-dimensional space and can thus be characterized according to whether it is hard or soft, pure or

applied, and concerned with life systems or not.

Insert Table 2 about here

This clustering suggests an analysis of variance approach to our examination of relationships between area task characteristics and department structure and output. Specifically,a three-way analysis of variance design corresponding to hard vs. soft, by pure vs. applied, by life system vs. non-life system was employed in the analysis of structure and output data. Thus each subject's data falls into one of the octants of this three-way design. In examining the way in which academic task characteristics mediate relationships between social connectedness and scholarly output,a four-way analysis of variance was performed. Here the four factors correspond to the high vs. low social connectedness times the three area task factors just mentioned.

Results and Discussion

Social Connectedness

Table 3 presents analyses of variance for relationships between academic task characteristics and social connectedness variables. Only statistically significant ($p < .01$) effects are presented. For main effects, cell means are shown in parentheses next to the name of the cell. Significant interactions are illustrated below.

Insert Table 3 about here

Table 2

Clustering of Academic Task Areas in Three Dimensions

	HARD		SOFT	
	Non-life System	Life System	Non-life System	Life System
Pure	Astronomy Chemistry Geology Math Physics	Botany Entomology Microbiology Physiology Zoology	English German History Philosophy Russian Communications	Anthropology Political Science Psychology Sociology
Applied	Ceramic Engineering Civil Engineering Computer Science Mechanical Engineering	Agronomy Dairy Science Horticulture Agricultural Economics	Accounting Finance Economics	Educational Administration and supervision Secondary and Continuing Education Special Education Vocational & Technical Education

Table 3

Analyses of Variance for Relationships Between

Academic Task Characteristics and Social Connectedness

(Only statistically significant ($p < .01$) effects are shown.)

Social Connectedness in Teaching

1. Number of people with whom respondent likes to work on teaching activities.

Source	DF	F	% Var.
B Pure (.93) - Applied (1.30)	1/584	10.13	2
C Non-life system (.94) - Life system (1.28)	1/584	8.85	1
ABC	1/584	12.43	2

2. Number of sources of influence on the courses the respondent teaches.

(No significant effects.)

3. Collaboration with other faculty members on teaching activities.

A Hard (.66) - Soft (.29)	1/429	17.52	4
C Non-life system (.28) - Life system (.68)	1/429	20.19	4
CA	1/429	9.36	2
ABC	1/429	16.34	3

Social Connectedness in Research

1. Number of people with whom respondent likes to work on research.

A Hard (1.93) - Soft (1.36)	1/584	14.29	2
B Pure (1.41) - Applied (1.88)	1/584	9.98	2

2. Number of sources of influence on research goals.

A Hard (2.12) - Soft (1.70)	1/569	21.74	3
B Pure (1.63) - Applied (2.18)	1/569	37.47	6
C Non-life system (1.79) - Life system (2.03)	1/569	6.94	1
AB	1/569	14.44	2

3. Number of faculty collaborators on research activities.

(No significant effects)

4. Number of journal co-authors.

A Hard (5.67) - Soft (.63)	1/473	47.48	9

Teaching. The first section of Table 3 shows that the number of people with whom scholars like to work in teaching is related to whether their area is pure or applied and to whether it is concerned with life systems or not. In applied areas, scholars like to work with more people on teaching than do their pure area counterparts. Scholars in areas which are concerned with biological or social systems report liking to work with more people on teaching than do scholars in other areas. Finally, there is a significant three-way interaction for the effects of task area on the number of people with whom scholars like to work. This interaction is illustrated in Figure 1. The interaction appears due to the differences between life system and non-life system areas in hard, pure and in soft, applied areas. In both cases, scholars in the life system areas report liking to work with more people on teaching than do their counterparts in non-life system areas.

Insert Figure 1 about here

The second social connectedness variable, the number of sources of influence on which courses the scholar teaches, did not differ according to the characteristics of the academic area.

Reported actual collaboration on teaching differed with academic task characteristics. Scholars collaborate with their colleagues to a significantly greater extent in hard as compared with soft areas and in life system as compared with other areas. Moreover, two significant interactions were found. These are shown in Figure 2. In the first, the amount of collaboration on teaching in hard and soft areas depends

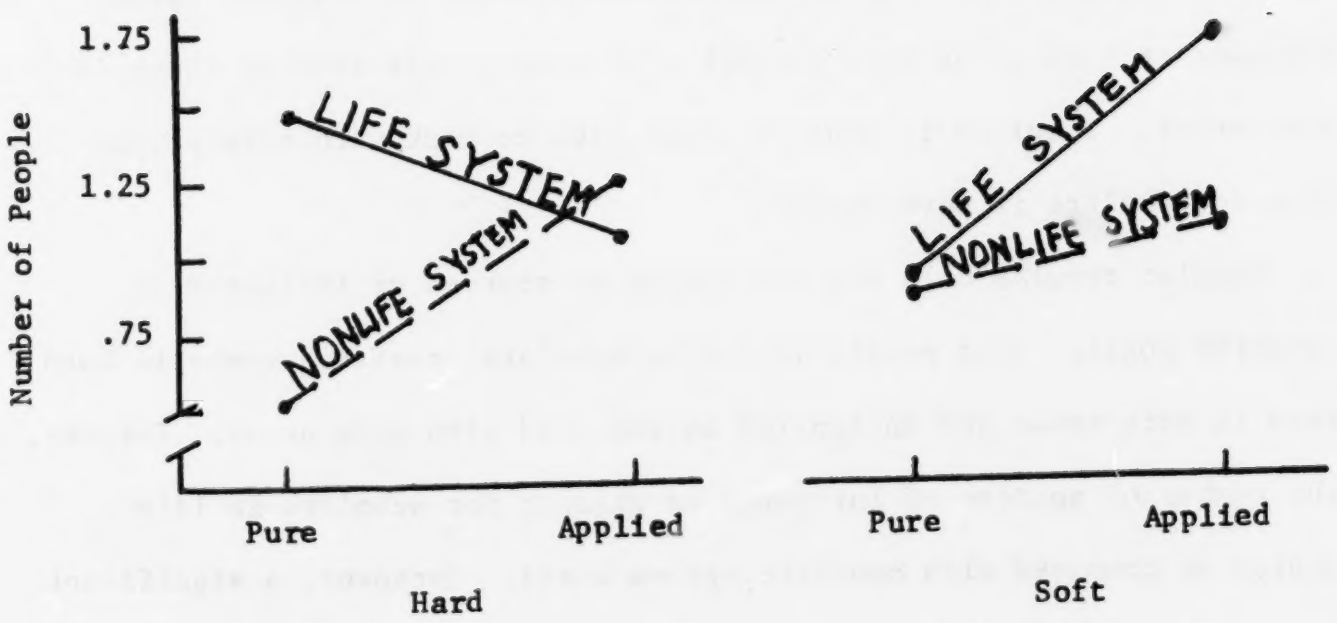


Figure 1

Three Way Interaction for Number of People

with Whom Respondent Likes to Work on Teaching

on whether or not the areas are concerned with life systems. Collaboration is distinctly higher in hard, life system areas. Examination of the three-way interaction shown in Figure 2 indicates that the overall two-way interaction is due to a two-way interaction in pure areas between the hard-soft and life system factors. In pure, hard areas, life system (life sciences) areas and non-life system areas (physical sciences) differ in the number of teaching collaborators; scholars in the hard, pure, life system areas collaborate with more people in teaching.

Insert Figure 2 about here

Research. The number of people with whom scholars like to work on research differs according to two characteristics of academic tasks. Scholars in hard areas like to work with more people than do those in soft areas. Scholars in applied areas like to work with more people than do scholars in pure areas.

Similar results hold for the number of sources of influence on research goals. More people influence scholars' research goals in hard than in soft areas and in applied as compared with pure areas. Further, the number of sources of influence is greater for scholars in life system as compared with non-life system areas. Moreover, a significant intereaction was found between the hard-soft and pure-applied factors. This interaction is shown in Figure 3. It appears due to the larger number of sources of influence for scholars in hard and applied areas such as

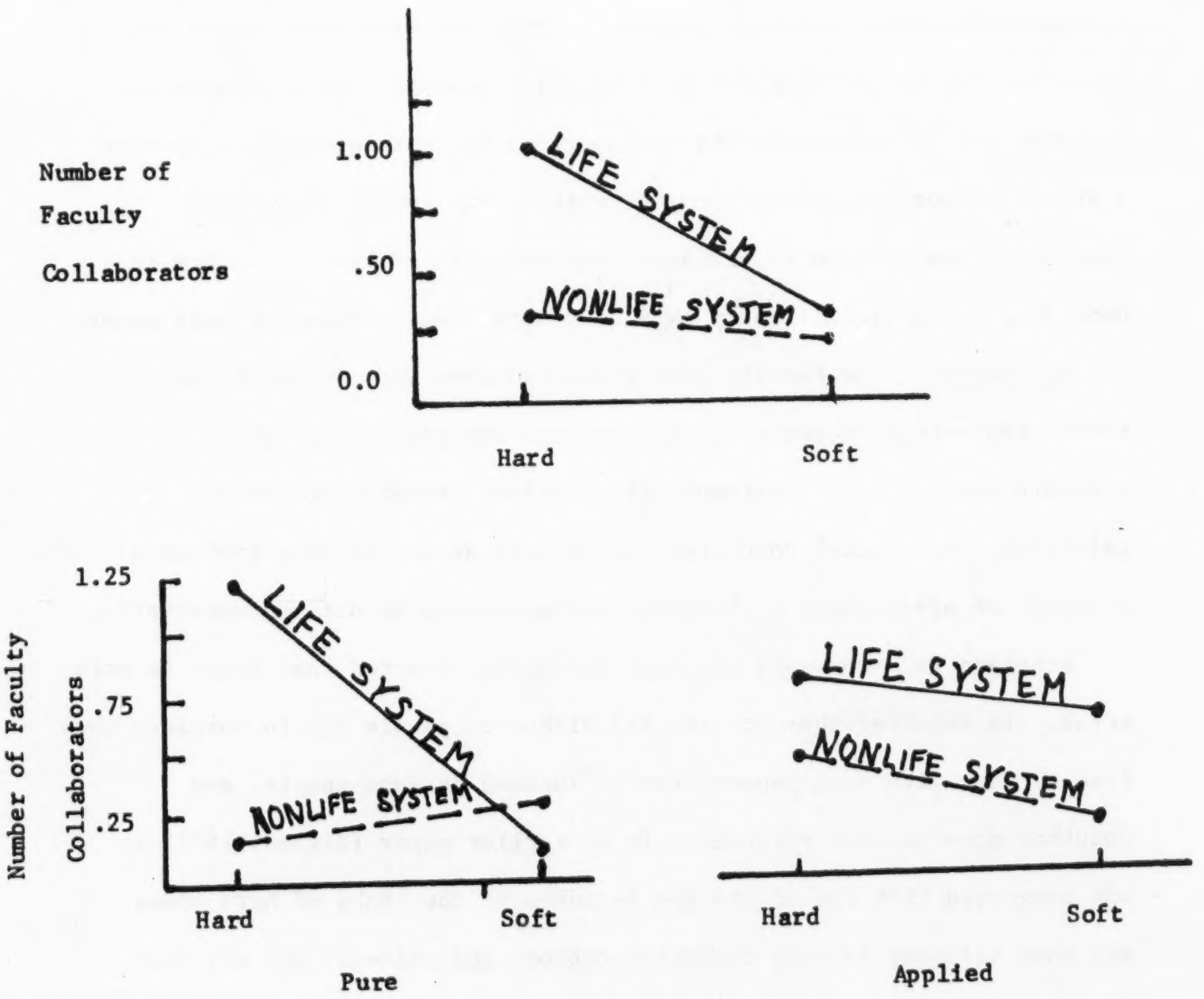


Figure 2

Interactions for Effects of Academic Task Characteristics on Collaboration with Other Faculty Members on Teaching

nuclear engineering and dairy science as compared with other areas.

Insert Figure 3 about here

The nature of the academic task was not related to the amount of collaboration which scholars reported. This may have been due to the unreliability of the research collaboration measure. Many respondents appeared not to understand the instructions for this question. However, a second measure of research collaboration, the number of journal coauthors, was related to academic task characteristics. Scholars in hard areas have significantly more coauthors than do those in soft areas.

Discussion. The results just presented show ways in which the social connectedness among faculty members depends on the nature of their academic area. It is congruent with previous research in showing relatively high social connectedness in hard areas but also indicates a number of areas where high social connectedness is not characteristic.

Scholars in hard areas are more socially connected than those in soft areas. In teaching they collaborate with more people and in research they like to work with more people, are influenced by more people, and coauthor more journal articles. In an earlier paper (Biglan, 1971) it was suggested that two of the key features of the tasks of hard areas are that (1) they involve objective methods and criteria and (2) they study physical objects. Both of these features are consistent with the finding of greater social connectedness in hard areas. To say that criteria are objective in hard areas means that evaluation of work in these fields is grounded in the judgments of the community of scholars.

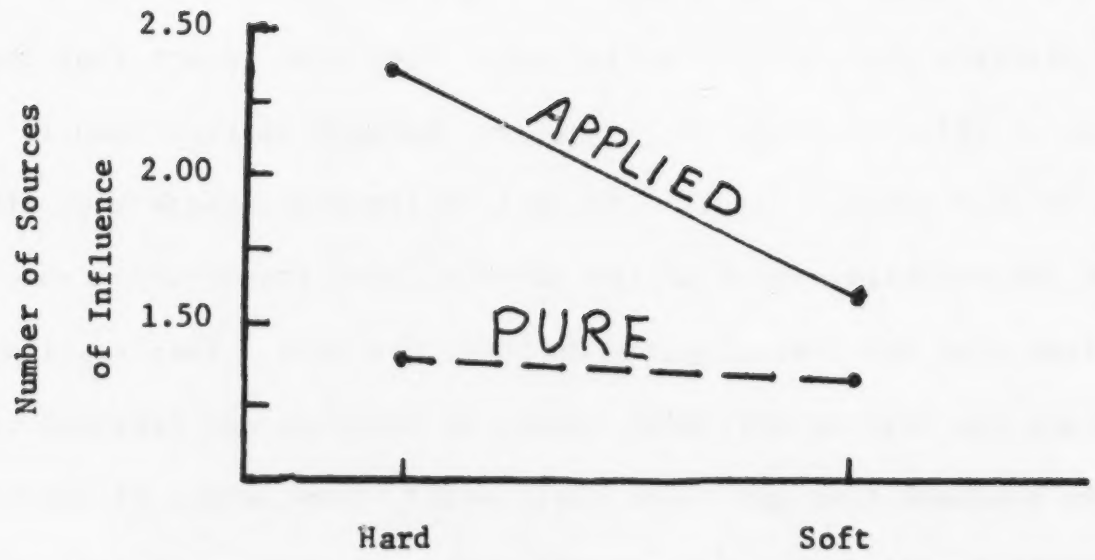


Figure 3

Interaction Between Hard Soft and Pure-Applied

Factors in Effects on Number of Sources

of Influence on Research Goals

Thus,one reason that objective criteria may promote social connectedness is that scholars in hard areas rely more heavily on the evaluations and feedback from their colleagues than do scholars in soft areas. Objective methods may also create opportunities for teamwork in research. Objective methods are understood by all members of the field. This allows scholars to fragment their research problems with some assurance that the individuals working on each fragment will use the same methods and hence that the results of research on the parts of the problem can be integrated. The concern with tangible objects of study may also lead to social connectedness since scholars may need to share scarce and expensive equipment. This could be why collaboration on teaching is higher in hard areas.

Social connectedness is greater in applied than it is in pure areas. Scholars in applied areas report liking to work with more people on both teaching and research activities. They also report that their choice of research goals is influenced by more sources than is the case in pure areas. Scholars in applied areas may check with others about the practical value of the material they are teaching and the problems they are investigating in their research. Thus,applied area scholars may like to work with others on teaching and research because of the feedback they get about their work. Examination of questionnaire responses revealed that the greater number of sources of influence on research goals for applied area scholars is primarily due to the influence of agencies outside universities such as industrial organizations. Moreover, the significant interaction between the hard-soft

factor and the pure-applied factor (illustrated in Figure 3) shows that the number of sources of influence on research goals is higher in hard, applied than in soft, applied areas. Thus, the influence of outside agencies on scholars' research goals is seen most clearly in agricultural and engineering areas.

Scholars in areas which are concerned with biological or social systems evidence greater social connectedness than do scholars in other areas. In teaching activities, they like to work with and actually collaborate with more people. Scholars in the former areas also are influenced by more sources concerning their research goals. Examination of the interactions involving the life system factor suggests that social connectedness may not be high in all biological areas for the same reason. Figure 1 shows that scholars in education areas and life science areas like to work with others on teaching. In education areas this is probably a matter of supervising student teachers. However, in life science areas at the University of Illinois, scholars conduct much of their graduate training in the context of their research laboratories. This approach to graduate education entails close contact with the graduate students and also with other faculty members who help to monitor the progress of individual students. When we turn to the interactions involving collaboration on teaching (shown in Figure 2) it can be seen that the difference between life system and other areas on this variable is primarily due to the greater amounts of collaboration in hard, pure, life system areas (the life sciences). As with the previous variable, this situation appears to be due to the method of

training graduate students in research laboratories.

It is not clear why the number of sources of influence on research goals is higher in life system areas. One possibility, for which data are not available,is that society has a more immediate and pressing concern for the products of research in these fields, since fields such as education and life sciences are more directly relevant to needs of large numbers of people. Hence,agencies of society directly shape the research being done in these fields. Examples of such agencies include the Ford Foundation, the American Cancer Society, and the U. S. Public Health Service.

In conclusion, the results presented here show that the amount of social connectedness among scholars is related to the characteristics of their academic tasks. Research in hard science areas has shown that scholars are socially connected. These findings cannot be generalized to areas which lack objective methods and criteria and do not study physical objects. In the latter soft areas, scholars are less socially connected. Moreover, scholars in applied areas are more socially connected than those in pure areas, apparently because in their concern with application they rely on others for feedback about the practical value of their work. Finally, social connectedness is greater in areas concerned with life systems. This seems to be due to the apprenticeship approach to graduate training in life science areas and the involvement of education areas in practice teaching.

Commitment

Table 4 presents results of the analysis of liking for and time spent

on: teaching, research, department administration, university administration,and service by scholars in different academic areas. This table shows that the extent of scholars' liking for teaching activities is related to whether they are in life system or non-life system areas. Scholars in soft areas express greater liking for teaching activities than do those in hard areas, and scholars in non-life system areas like teaching more than do those in areas concerned with life systems. There are essentially the same results for the time actually spent on teaching. Scholars in soft areas spend more time teaching than do those in hard areas,and scholars in non-life system areas spend more time on teaching than do those in life system areas. There is also a significant three-way interaction of the effects of the area task factors on time spent on teaching. The interaction is presented in graphic form in Figure 4. It appears to be due to the smaller amount of time spent on teaching by scholars in agricultural fields (hard, applied, life system) as compared with scholars in other fields.

Insert Table 4 and Figure 4 about here

Commitment to research varies with academic area in a number of ways. First, scholars in hard areas report liking research more than do scholars in soft areas,and they report spending more time on it. There were significant three-way interactions for both liking for and time spent on research. The pattern for both interactions is the same: The difference between hard and soft areas in commitment to research is

Table 4

Analyses of Variance for Relationships Between Academic Task Characteristics and Commitment to Teaching, Research, Administration, and Service Activities

1. Teaching

Source	DF	F	% Var.
Preference			
A Hard (37.1) - Soft (48.7)	1/620	41.63	6
C Nonlife system (47.6) - Life system (38.7)	1/620	26.40	4
Hours per Week			
A Hard (19.1) - Soft (26.4)	1/603	42.29	6
C Nonlife system (26.3) - Life system (20.2)	1/603	21.50	3
ABC Interaction	1/603	9.96	1

2. Research

Preference			
A Hard (41.1) - Soft (31.8)	1/620	22.89	3
B Pure (39.7) - Applied (33.3)	1/620	11.02	2
ABC Interaction	1/620	21.08	3
Hours per Week			
A Hard (23.0) - Soft (15.1)	1/603	37.97	6
ABC Interaction	1/603	13.79	2

3. Department Administration - (No effects significant at .01 level.)

4. University Administration - (No effects significant at .01 level.)

5. Service

Preference			
B Pure (3.4) - Applied (7.8)	1/620	33.81	5
CA Interaction	1/620	18.16	3
ABC Interaction	1/620	15.49	2
Hours per Week			
B Pure (2.6) - Applied (4.4)	1/603	12.75	2

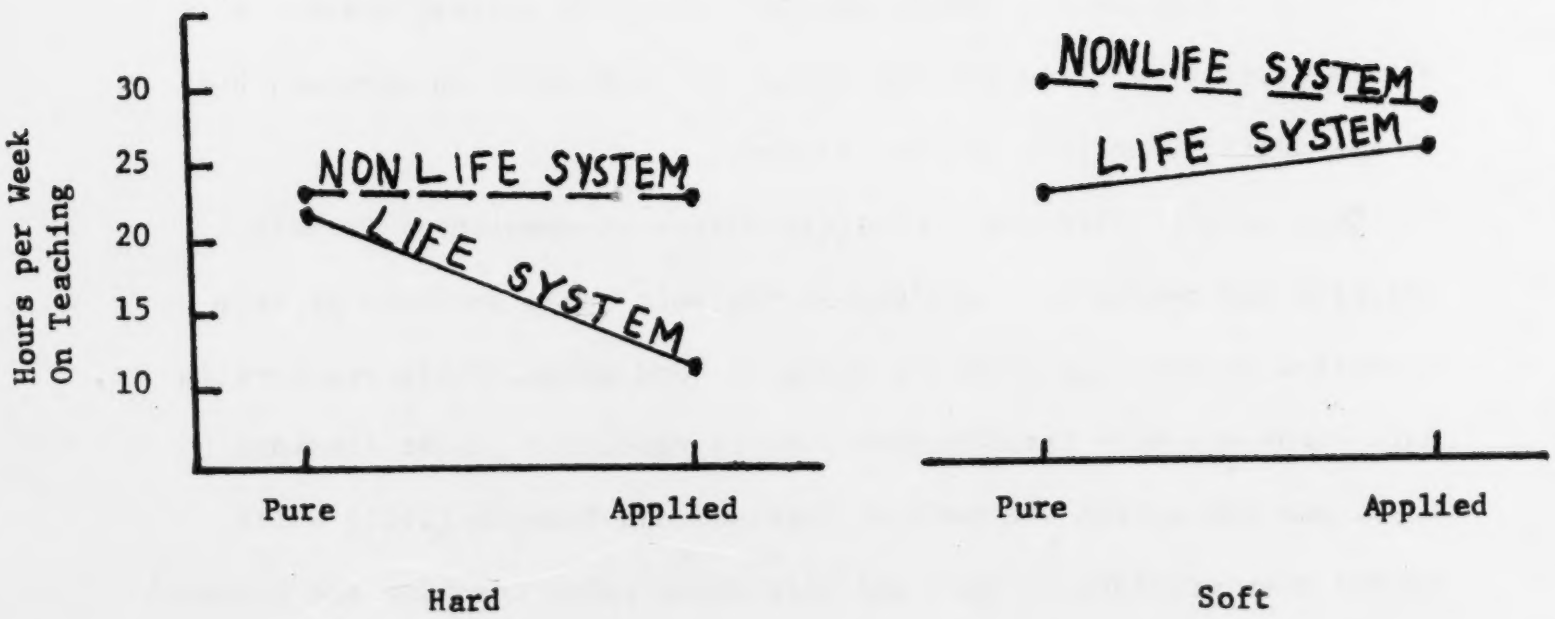


Figure 4

Interaction Among Three Task Factors for Time on Teaching

greatest for applied life system areas (agriculture vs. education) and pure, non-life system areas (physical sciences vs. humanities). A main effect for the pure-applied factor shows that scholars in pure areas like research more than do those in applied areas.

No significant relationships were found between academic areas and the extent to which scholars spend time on and like department administration and university administration.

The preference of scholars for service activities is related to whether an academic task area is pure or applied. Applied area scholars like service activities more than do those in pure areas, and applied area scholars actually devote more time to service activities. Two- and three-way interactions for liking for service show that the difference between pure and applied scholars is primarily due to the high degree of liking for service indicated by scholars in education (soft, applied, life system) and engineering (hard, applied, non-life system) areas. A similar result occurred for the amount of time spent on service, but it was significant only at the .05 level.

Discussion. Hard and soft areas differ in commitment to both teaching and research. Scholars in the soft areas are more greatly committed to teaching than are those in hard areas, while scholars in hard areas are more greatly committed to research. These findings replicate and extend the work of Vreeland and Bidwell (1966) which showed that scholars in hard and soft areas value teaching and research differently. The results of this study show that value differences are paralleled by differences in the time that scholars actually spend

on teaching and research. At least two factors may be cited to explain differences in commitment. First, data not reported here show that at the University of Illinois, scholars in hard areas have more money available to support research activities. Second, more graduate training takes place in the research setting in hard areas, as compared with soft areas. Graduate training in hard areas is an apprenticeship system where graduate students assist faculty members with research and conduct their own research under the supervision of the faculty. However, in soft areas, scholars conduct their research more independently (c.f., the results for social connectedness which were presented above). Thus, less graduate training may be taking place in the research setting in soft areas.

Not surprisingly, there is a strong commitment to service activities in applied areas. Particularly in education and engineering areas, scholars express a preference for service activities and devote more time to them. Perhaps as a compensation for their commitment to service, scholars in applied areas report less liking for research than do those in pure areas. There are, however, no differences in the time actually spent on research.

Scholars in life system areas are less committed to teaching than are scholars in other areas. They like teaching less and spend less time on it. A significant three-way interaction shows that particularly scholars in agricultural areas spend a small amount of time on teaching.

Our examination of scholarly commitment provides answers to a number of the questions raised above. First, scholars differ not only

in their commitments to teaching and research, but also in their commitment to service activities. This points to the need for considering the service activities of scholars in applied areas when evaluating them. Second, it appears that emphasis on teaching in certain areas is generally compensated for by less emphasis on research. And conversely, in some areas there is great emphasis on research and relative deemphasis on teaching. It would be unsafe to draw such a conclusion from the preference data alone, since scholars were forced to distribute a fixed number of points among the various activities. However, the same result holds for time allocation data where data were not ipsative. A third conclusion to be drawn from the commitment results is that differences in scholars' preferences for teaching, research, and service are generally matched by differences in the time they actually allot to these activities. This finding underscores the need for standards for evaluating faculty members which weight teaching, research, and service according to the norms of the particular field. It appears that one set of standards for all scholars is not appropriate.

Scholarly Output

Table 5 presents results of analysis of relationships between area task factors and the following measures of scholarly output: (1) number of monographs, (2) number of journal articles, (3) number of dissertations sponsored; (4) number of technical reports, (5) quality of journal articles, and (6) graduate students' first job quality.

Insert Table 5 about here

Table 5

Analysis of Variance for Relationships

Between Academic Task Characteristics and Scholarly Output

(Only significant effects ($p < .01$) are reported. Publication data is from the years 1964-1967.)

Source	DF	F	% Variance
Number of Monographs			
A Hard (.08) - Soft (.28)	1/473	14.54	3
Number of Journal Articles			
A Hard (6.21) - Soft (2.72)	1/473	25.31	5
Number of Dissertations Sponsored			
(No significant effects)			
Number of Technical Reports			
B Pure (.16) - Applied (.46)	1/473	6.64	1
Quality of Journal Articles			
(No significant effects)			
Graduate Students' First Job Quality			
B Pure (4.85) - Applied (5.82)	1/75	10.30	11

Hard and soft areas differ on three measures of scholarly output. Compared to scholars in soft areas, scholars in hard areas publish fewer monographs and more journal articles. It was suggested earlier that hard areas have more objective methods and criteria than do soft areas. This could account for the relatively greater emphasis placed on journal articles in hard areas. In areas where methods and criteria are objective, it is not necessary to describe them in great detail since they are generally familiar to all people in the field. In this case, journal articles, with their restrictions on length, provide an appropriate means of communication. In the absence of objectivity, however, scholarly products are more idiosyncratic. In this case, monographs are an appropriate means of communication since they provide space in which the scholar can discuss the assumptions on which his work is based, his method or approach to the problem,and his criteria for evaluating his own response to the problem.

There was a significant interaction between the hard-soft and life system factors on the rated quality of journal articles. The mean rated quality of journal articles is higher in hard non-life system areas such as physics and engineering. This result could be due to the greater emphasis placed on journal articles by scholars in these areas; they may rate journal articles more highly in general.

Pure and applied areas differ in the production of technical reports and the rated quality of graduate students'first jobs. Scholars in applied areas produce more technical reports and rate the first jobs of their graduate students more highly. The finding concerning technical reports is congruent with the finding that scholars in applied areas are more greatly committed to research. Presumably, technical reports provide an ideal way for applied area scholars to communicate the results of

their research in detail to the groups and individuals for whom they provide service.

These findings point again to the importance of developing appropriate standards in each area for the evaluation of faculty members. The areas in our sample differ in the emphasis they place on monographs, journal articles, and technical reports. Therefore, the weight given to each form of publication for evaluation purposes should not be the same in all areas.

Social Connectedness and Scholarly Output

Research reviewed earlier indicated that social connectedness is positively related to scholarly output in hard science areas. In the present section we are concerned with two related questions. First, is social connectedness positively associated with scholarly output in all academic areas? Second, does the relationship between social connectedness and scholarly output depend on the kind of academic area?

Table 6 presents results relevant to the first question. For two kinds of scholarly outputs, journal articles and sponsored dissertations, productivity is higher for the more socially connected scholars. Thus, at least to an extent, social connectedness appears generally to enhance scholarly productivity. However, examination of the interactions between connectedness and academic task factors on scholarly output show that such a statement is oversimple. The remainder of this section presents and discusses these interactions.

Insert Table 6 about here

Table 6

Main Effects - Social Connectedness on Scholarly Output

($p < .05$)

Variable	Social Connectedness Level Mean High	Low	DF	F	% Variance
Number of Journal Articles	5.16	3.77	1/473	3.99	1
Dissertations sponsored	1.40	.86	1/473	4.77	1

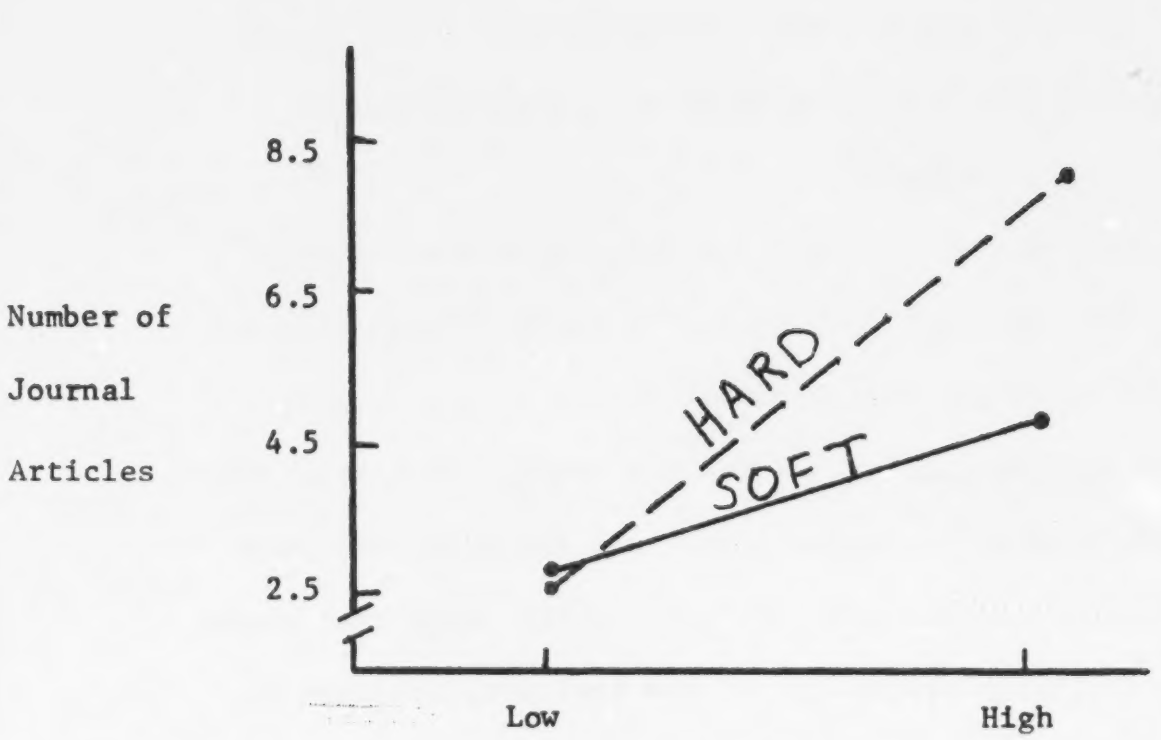
Research Output. Significant interactions occurred between social connectedness and area task factors in their relationship to three measures of research output: monograph publication rate, journal article publication rate, and the rate of technical report publication. A fourth measure of research output, the rated quality of journal articles, was not related to social connectedness either directly or in interaction with task factors.

There was a significant interaction between social connectedness and the pure-applied task factor on rate of monograph publication ($F_{1,473} = 4.09$). In pure areas, connectedness is positively related to monograph publication; but in applied areas, the scholar's social connectedness makes no difference.

Figure 5 illustrates a significant interaction between social connectedness and the hard-soft task factor in their relationship to journal article publication. Social connectedness is more strongly related to journal article publication in hard areas. Technical report publication is also related to connectedness and the hard-soft task factor. The significant interaction ($F_{1,473} = 4.32$) shows that social connectedness and technical report output are positively related in hard areas and negatively related in soft areas.

Insert Figure 5 about here

A second interaction for technical reports is illustrated in Figure 6. The interaction is among social connectedness, the pure-applied task factor, and the life system task factor. Social connectedness and



$F_{1,473} = 6.22$

Figure 5

Interaction Between Social Connectedness and

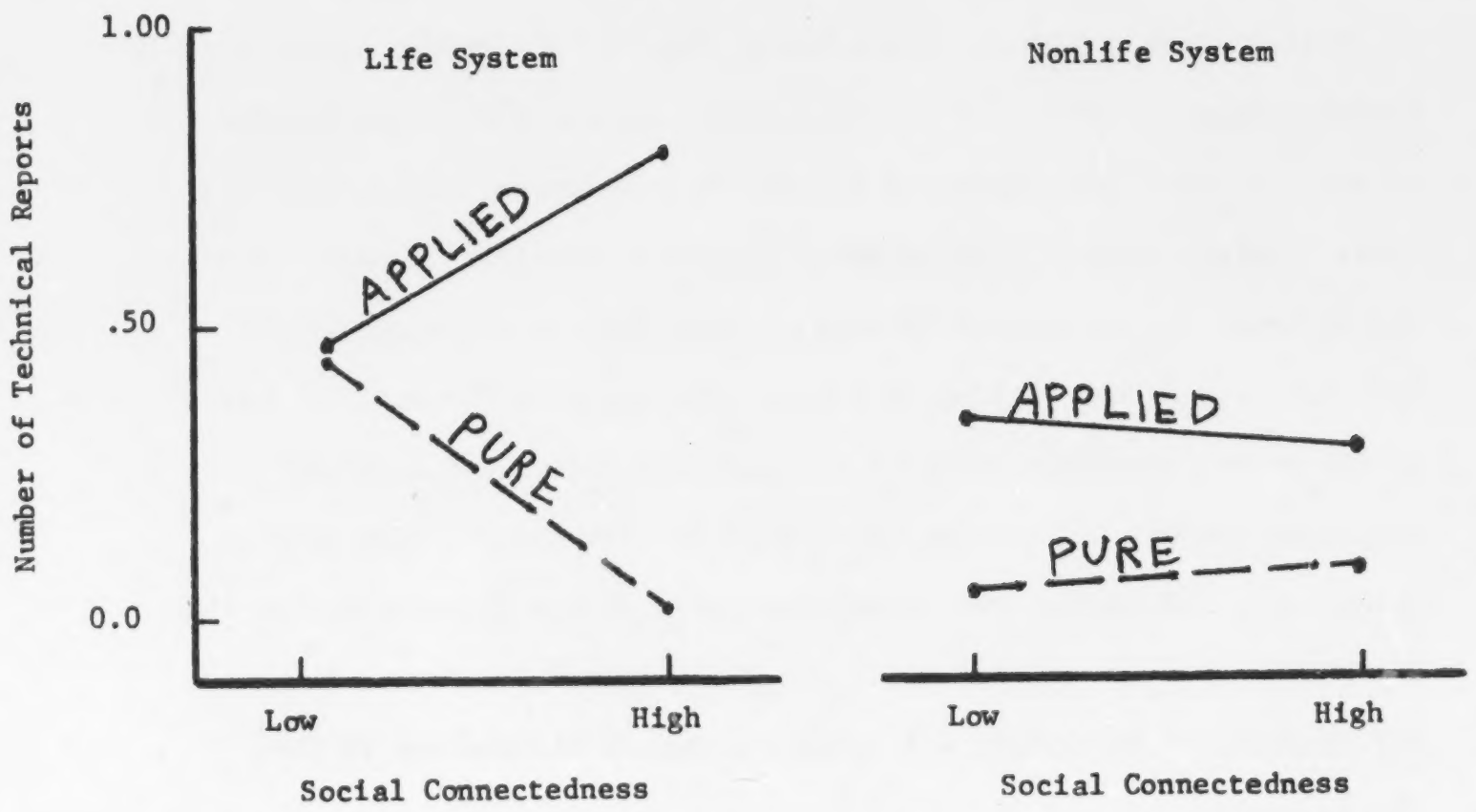
the Hard-Soft Task Factor on Journal Article Publications

technical report output are positively related in applied life system areas (education, agriculture),negatively related in pure life system areas (life and social sciences), and unrelated in other areas.

Insert Figure 6 about here

The interactions between social connectedness and task factors in their effects on monograph and technical report publication form a consistent pattern. First,it was found that social connectedness and monograph publication are positively related in pure areas and unrelated in applied areas. Second, it was found that in life system areas, social connectedness and technical report publication are positively related in applied areas and negatively related in pure areas. Taken together these findings suggest that socially connected scholars in pure life system areas are encouraged by those around them to write monographs and discouraged from writing technical reports, while in applied life system areas, socially connected scholars are encouraged to write technical reports and neither encouraged nor discouraged from writing monographs. Of course, this reasoning rests on the assumption that the interaction between connectedness and the pure-applied factor in their relationship to monographs was primarily due to differences in life system areas.

Consistency also exists concerning relationships between social connectedness and research outputs in hard and soft areas. In hard areas, social connectedness is positively related to both journal articles and technical report publication rates. In soft areas, connectedness shows a



$F_{1,473}=4.25$

Figure 6

Interaction Among Social Connectedness,

the Pure-Applied Task Factor and the Life System

Task Factor on Number of Technical Reports

slight positive relationship with journal article publication and a slight negative relationship with technical report publication rates. It was suggested above that objective methods and criteria in hard areas allow problems to be fragmented and thereby make teamwork in research feasible. It appears from these results that teamwork is not only feasible in hard areas, but is the most effective way of conducting research. Objectivity could also be the reason for these results. Objectivity ultimately means that others must agree with the individual scholar. Thus, working with others may provide needed feedback. Moreover, objectivity requires that the scholar's research fit with existing knowledge. Obviously this requirement cannot be met unless the scholar is aware of relevant research. Menzel's (1962) study of communication patterns in natural sciences is relevant in this regard. He found that a large portion of the information which researchers in these areas use comes from colleagues, despite the fact that it is available in journals. This situation probably holds true in other hard areas.

These results show why it is unwise to assume that the social connectedness of scholars bears the same relationship to research output in all academic areas. Depending on the task characteristics of the area and the particular measure, social connectedness and research output may be positively or negatively related or unrelated. It is not possible to draw a firm conclusion about the direction of causality for these data since they are essentially correlational. Although it is tempting to conclude from a positive relationship between connectedness

and output that connectedness leads to research productivity, it is also possible that high research productivity provides opportunities for social connectedness. If, in fact, positive relationships occur because connectedness enhances productivity, it will be important to avoid physical segregation of scholars such as occurs at universities where departments have expanded to several different buildings.

Graduate Training. Significant interactions occurred between social connectedness and the life system factor as they are related to the number of dissertations sponsored ($F_{1,473} = 6.91$) and the quality of graduate students' first jobs ($F_{1,473} = 8.57$). Social connectedness is positively related to both variables in areas which do not involve life systems, but it is not related to them in life system areas.

Figure 7 presents an interaction between social connectedness and the hard-soft and pure-applied task factors as they are related to the number of dissertations sponsored. Positive relationships between connectedness and dissertations occurred in hard, pure areas such as physics and physiology and in soft applied areas such as education and finance. The variables are unrelated in other areas. An almost identical interaction occurred for the quality of graduate students' first jobs ($F_{1,473} = 7.17$); it is positively related to social connectedness in hard, pure areas and in soft, applied areas. Social connectedness and job quality are unrelated in the remaining areas.

Insert Figure 7 about here

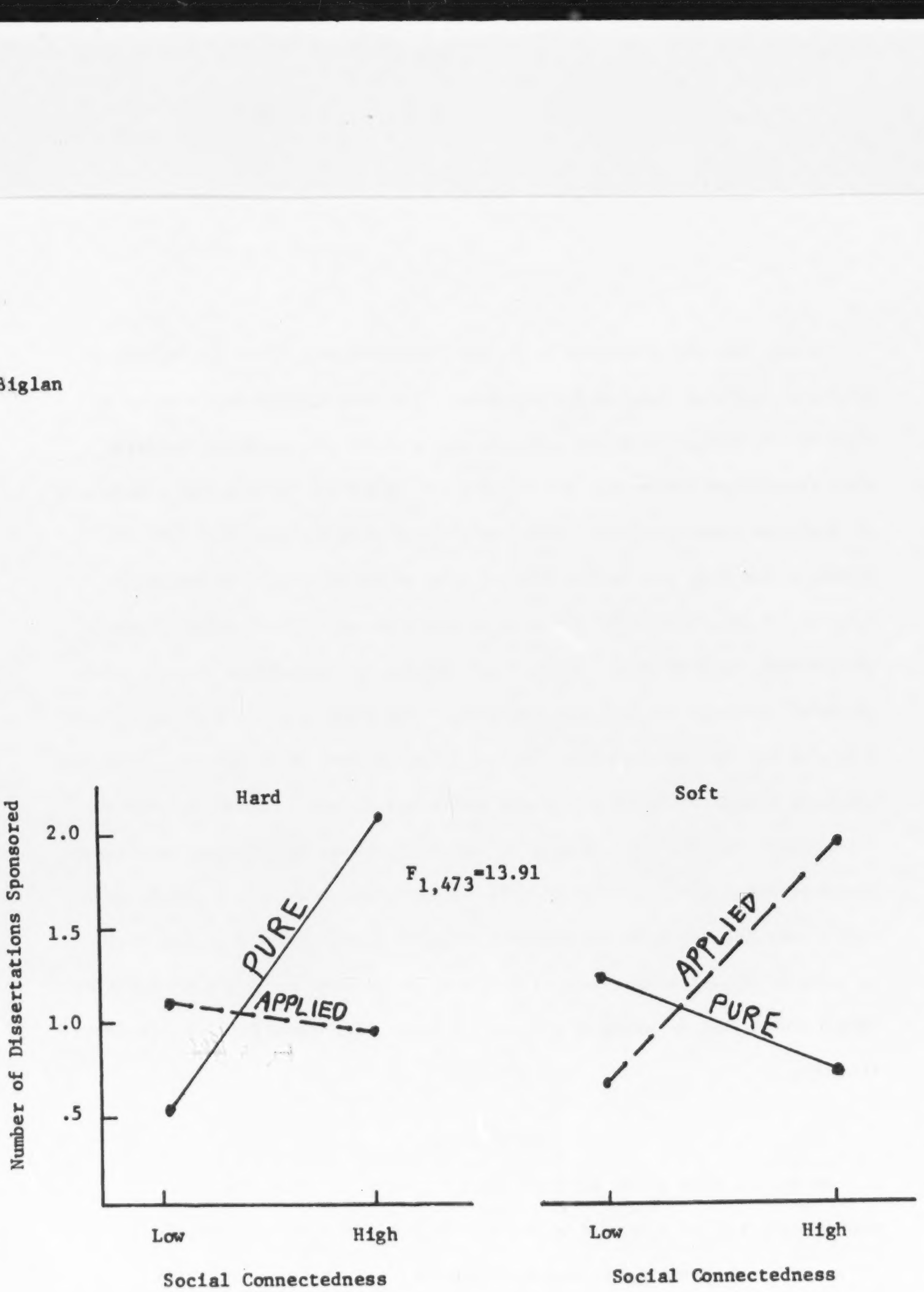


Figure 7

Interaction Among Social Connectedness, the Hard-Soft Factor, and the Pure-Applied Factor on Number of Dissertations Sponsored

We may ask why a scholar's social connectedness would be related to graduate training outputs in any area. The most likely explanation is that the socially connected scholar can provide his graduate students with facilities and access to information which facilitate the completion of doctoral dissertations. Moreover, the socially connected scholar probably has more and better contacts in other universities which are helpful in obtaining jobs for his graduate students. If this reasoning is correct, we must still explain why social connectedness is unrelated to these measures of graduate training. The best clue to this is provided by the findings that social connectedness is related to graduate training output in non-life system areas but is not related to them in life system areas. In a number of the life system areas, the department administration plays a central role in providing graduate students with facilities for research and placing them in jobs. This suggests that in general social connectedness will not be related to graduate training outputs when the department as a whole takes responsibility for graduate training.

Conclusion

In brief, this study defines specific ways in which the task characteristics of academic areas are related to scholars' social commitment, research output, and graduate training outputs. A number of conclusions are appropriate.

1. At least for one kind of organization, the university, the characteristics of their intellective tasks are an important variable for understanding structure and output. Studies of the task in

organizations have been restricted to motor manipulative tasks, and organizations with intellective tasks have not been subjected to task studies. This study shows task studies in the latter organizations are fruitful. Besides universities, organizations whose tasks are primarily intellective include consulting firms, law firms, research and development units in large industrial corporations, and the judicial and legislative branches of government.

2. This study points to the necessity for considering academic area when conducting research in universities. Numerous studies of scholarly work in natural science areas have been reported (Pelz and Andrews, 1966; Menzel, 1962). These studies are probably not generalizable to other areas. On the other hand, many investigators may be tempted to pool data from different areas. The present study suggests that such a procedure will mask specific and different relationships among variables in different areas.

3. Finally, it is useful to reiterate the implications of this study for evaluating faculty members. At least three of the results of this study call into question the practice of evaluating faculty members on the basis of their journal article publications. First, scholars in some areas express greater interest in research than do those in other areas. Second, scholars differ in the amount of time which they actually spend on research. Third, they differ in their rate of journal article publications. These results show how evaluation of scholars in terms of their journal articles will not always accurately reflect their research performance and will neglect their performance

on non-research activities which take considerable portions of their time and energy. For example, applied areas are more heavily involved in service tasks and produce more technical reports, presumably for the groups to whom they provide services. The journal articles of people in these areas represent only a portion of their research output and may in no way reflect what these scholars may be doing for the agencies with whom they consult.

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Footnotes

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